INSTRUCTION MANUAL

1013

THE BIRTCHER CORPORATION INSTRUMENT DIVISION
1200 MONTEREY PASS ROAD, MONTEREY PARK, CALIFORNIA

TYPE 10 CD

SEMICONDUCTOR LEAKAGE

AND BREAKDOWN TEST MODULE

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SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The Birtcher Model 10CD is used with the Birtcher Model 70 basic unit to measure leakage currents and breakdown voltages of semiconductors. The extreme ranges incorporated in the 10CD Module permit leakage measurements down to 100 picoamperes full-scale, leakage and breakdown voltage measurements up to 1000 volts. A regulated current or voltage test potential allows rapid testing of production size lots.

Two plug-in test adapters are provided with the type 10CD. The Leakage and Breakdown Plug-In is for all breakdown measurements and leakage tests down to 1 microampere, using the basic unit test jacks; the Low Leakage Function Plug-In contains its own small-case test socket and is used for the lowest leakage ranges.

SPECIFICATIONS

TESTS PERFORMED:

Transistors: BV_{CBO}, BV_{EBO}, BV_{CEO}, BV_{CER}, BV_{CES}, I_{CBO}, I_{CEO}, I_{CER}, I_{CES}

Diodes: I_R, V_R

VOLTAGE RANGES:

10, 30, 100, 300, 1000 Volts (Output voltage limited to approximately 850V at currents above 100 microamperes).

CURRENT RANGES:

100, 300 picoamperes; 1, 3, 10, 30, 100, 300 nanoamperes; 1, 3, 10, 30, 100, 300 microamperes; 1, 3, 10 milliamperes (lowest current range for breakdown tests is 1 microampere).

ACCURACY:

Voltage: $\pm$ 2% of full scale range.

Current: $\pm$ 2% of full scale range $\pm$ 10 picoamperes.

CONSTRUCTION:

Aluminum alloy chassis; anodized front panel with color-coded controls.

SPECIFICATIONS (cont'd)

WEIGHT:

7 pounds.

DIMENSIONS:

8 1/2'' wide x 7'' high x 13'' deep.

SECTION 2

OPERATION

GENERAL OPERATION

For ease and convenience of operation, the front panel of the Model 70 Semiconductor Test Set, including the type 10CD Test Module has been divided into two functional sections. To aid the operator in learning and remembering the basic operation of the instrument, different colors are used for the markings in each section.

FUNCTION OF CONTROLS AND METERS

MODEL 70 BASIC UNIT:

Upper Meter:

Indicates voltage across semiconductor under test.

Upper Adjust Control:

Provides adjustment of test potential across semiconductor under test.

Lower Meter:

Indicates current through semiconductor under test.

Lower Adjust Control:

Used in full CW position for all tests, to provide high voltage source.

Test Switch:

Controls application of test potential across semiconductor.

Overload Lamp:

Indicates overload condition.

10CD TEST MODULE:

Voltage Range Switch:

Selects range of upper meter, and test supply on leakage measurements.

FUNCTION OF CONTROLS AND METERS (cont'd)

Current Range Switch:

Selects range of lower meter, and test supply on breakdown measurements.

Voltage Zero:

Provides adjustment of voltmeter zero after warm-up.

Mode Switch:

Selects leakage or breakdown operation.

Caution Lamp:

Indicates high test potential at test terminals on all voltage ranges in breakdown mode, and on the 300V and 1000V ranges in leakage mode.

LEAKAGE AND BREAKDOWN FUNCTION PLUG-IN (20035)

Polarity Switch:

Selects polarity for NPN or PNP transistors.

Parameter Switch:

Selects parameter to be measured.

LOW LEAKAGE PLUG-IN (20036)

Parameter Switch:

Provides indication of transistor lead connections.

INITIAL TURN ON

Install the 10CD Test Module in the Model 70 Semiconductor Test Set and connect the Model 70 to a primary power source. Set the front panel controls as follows:

1. Turn UPPER ADJUST control fully counter-clockwise.

2. Turn LOWER ADJUST control fully clockwise.

INITIAL TURN ON (cont'd)

3. Put power switch in ON position.

4. After warm-up period of 1-2 minutes, zero voltmeter with the ZERO control, with test switch in reset position.

SEMICONDUCTOR CONNECTIONS

BREAKDOWN TESTS

For all breakdown tests, the LEAKAGE AND BREAKDOWN FUNCTION PLUG-IN is used. With this plug-in, the basic unit TEST JACKS are used for semiconductor connections. The type of transistor to be tested and the parameter to be measured are selected by switches on the function plug-in.

LEAKAGE TESTS

The LEAKAGE AND BREAKDOWN FUNCTION PLUG-IN may be used in conjunction with the Basic Unit test jacks and test adapter on the following ranges:

TEST VOLTAGE RANGE	MINIMUM CURRENT FULL SCALE
1000V	100 na
300V	30 na
100V	10 na
30V	3 na
10V	1 na

For leakage measurements lower than those listed above, the LOW LEAKAGE FUNCTION PLUG-IN should be used.

The unused function plug-in is stored in the top rear of the 10CD module. The banana-plug contacts of the unused plug-in hold it in place.

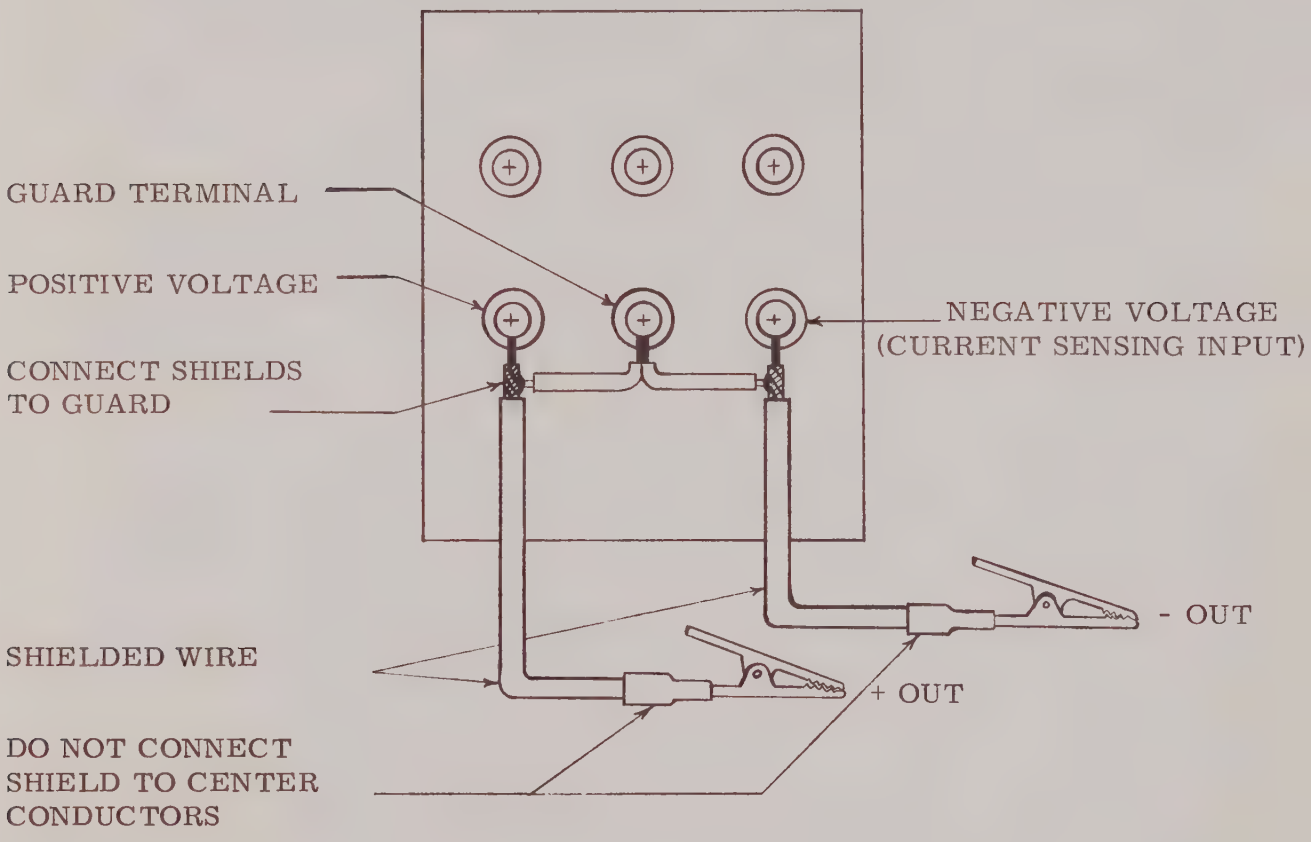
EXTERNAL DEVICE CONNECTIONS

For low leakage measurements that can not be made with the Low Leakage Function Plug-In, connection can be made to an external device by utilizing shield wire as shown in figure 2-1.

SEMICONDUCTOR CONNECTIONS (cont'd)

FIGURE 2-1

10CD TEST ADAPTER JACKS



LEAKAGE MEASUREMENT

1. Refer to semiconductor connection section on page 5 for selection of proper test adapter.

2. Set the TEST MODE selector to LEAKAGE.

3. Set the plug-in PARAMETER SWITCH to the desired parameter and polarity.

   When using the LOW LEAKAGE FUNCTION plug-in insert the transistor leads in the jacks indicated in the PARAMETER SELECTOR window. For diodes, connect the diode between the binding posts as indicated by the panel symbol.

LEAKAGE MEASUREMENT (cont'd)

4. Set the VOLTAGE and CURRENT RANGE SWITCHES to the desired ranges.

5. Adjust VOLTAGE ZERO CONTROL for zero on both meters.

6. Depress the TEST switch and set the UPPER ADJUST control for the required test voltage (indicated on the UPPER METER).

7. Read the leakage current on the LOWER METER.

CAUTION!

This instrument provides a capability for measurement of extremely low leakage currents; in order to accurately measure these currents some precautions must be observed; device lead length and proximity of the operator may affect readings; to minimize these effects, insert the transistor as far as possible and keep hands away from the case.

NOTE: If the current through the semiconductor under test is greater than 3 times full-scale, the basic unit overload circuit will remove the test potential and light the overload lamp. The overload circuit is reset by releasing the TEST switch to the RESET position.

Current overload indication may be due to a faulty device, improper polarity switch setting, or too low current range.

BREAKDOWN MEASUREMENT

1. The LEAKAGE and BREAKDOWN FUNCTION PLUG-IN is used.

2. Set the TEST MODE selector to BREAKDOWN.

3. Set the FUNCTION PLUG-IN PARAMETER switch to the desired parameter and the POLARITY switch to the required polarity.

4. Set the VOLTAGE and CURRENT RANGE SELECTORS to the desired range.

5. Depress the TEST switch and set the UPPER ADJUST control for the required test current (indicated on the LOWER METER).

6. Read the breakdown voltage on the UPPER METER.

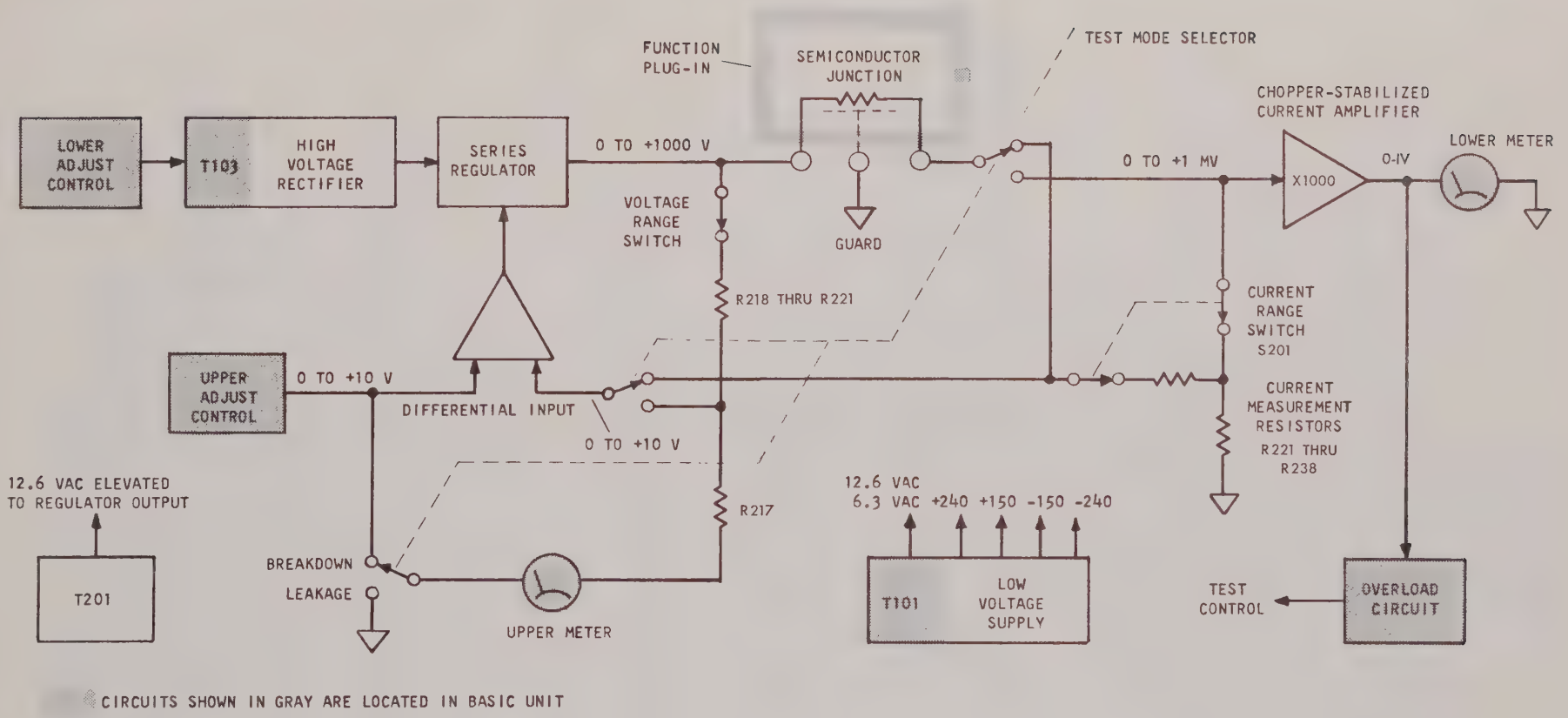


FIGURE 3-1 10 CD BLOCK DIAGRAM

SECTION 3

THEORY OF OPERATION

BLOCK DIAGRAM

Figure 3-1 illustrates the configuration of the 10CD Test Module in block form.

Leakage and breakdown tests involve only a single junction within a semiconductor, thus only two connections are made to the semiconductor under test. The test supply provides proper bias to the junction under test with the voltmeter reading the voltage across the junction and a chopper stabilized current amplifier reading current flowing through the junction. The difference between leakage and breakdown test is that on leakage tests a constant voltage is supplied to the semiconductor junction; on breakdown tests a constant current is supplied to the semiconductor junction.

The type of tests to be performed on a semiconductor, (i.e. leakage or breakdown) is selected by the test supply mode switch located on the test module. The particular parameter to be measured and the semiconductor polarity (NPN or PNP) are selected by means of switches on the plug-in test adapters.

TEST SUPPLY

Bias applied to the semiconductor under test is supplied by an electronically regulated power supply, capable of providing constant voltage or current outputs.

Supply regulation is achieved by using a differential input amplifier, V202, direct coupled to a shunt regulator, V201, with the plate of the shunt regulator connected to the grids of the series regulating tubes V203 and V204. A regulated reference voltage is applied to one input of the differential amplifier; feedback voltage is applied to the other input of the differential amplifier. The phasing of the amplifier is such that with feedback the differential inputs are maintained at an equal voltage.

On leakage measurements feedback voltage for the amplifier is developed across resistor R217. Resistors R218 thru R221 (voltmeter range resistors) in series with the output of the supply provide supply ranging.

On breakdown measurements feedback voltage is developed across current measuring resistors R222 thru R238. The value of these resistors is such that 10 volts will be developed across them for full-scale current indication. These resistors are selected by the current range switch S202.

VOLTMETER

Voltage across the semiconductor junction is measured by the voltmeter (upper, Model 70). Range resistors R217 thru R221 are selected by the voltage range switch S201. On leakage measurements the negative side of the voltmeter is connected to ground; this provides an accurate indication of the voltage developed across the semiconductor junction as there is only a one millivolt difference between the return side of the semiconductor junction and ground. On breakdown measurements the negative side of the voltmeter is connected to the bias supply reference voltage. As the voltages at the differential amplifier inputs are equal, accurate indication of breakdown voltage is obtained.

CURRENT METER

Current is measured by means of a chopper stabilized current amplifier. A 0 to 1 millivolt signal developed across current measuring resistors R222 thru R238 is applied to an electro-mechanical chopper through a low-pass filter C210, C211, R244 and R245. The filter attenuates AC components present on any input signal and the chopper converts the remaining DC component to a square wave.

An AC coupled amplifier amplifies the chopper output about 500, 000 times. A second set of contacts on the chopper are used to demodulate the amplifier output. The output of the demodulator is filtered and applied through a cathode follower to a feedback network and current meter (lower, Model 70). The feedback network stabilizes the DC gain of the modulator-amplifier-demodulator system to a value of approximately 1000, providing an output of 1 volt for an input of 1 millivolt. Resistors in series with the current meter adjust its sensitivity to approximately 1 volt full-scale.

SECTION 4

MAINTENANCE

INSTRUCTION MANUAL

A Birtcher instruction manual sometimes contains hand made changes to diagrams, parts lists, and texts. These changes are generally appropriate only to the instrument for which the manual was prepared. The changes, if any, have been made since the printing of the manual.

There is a serial number on the warranty page of this manual. This serial number corresponds to the serial number of your instrument. When ordering replacement parts, make certain the manual serial number matches the serial number of the instrument.

NOTE: Always include the instrument type and serial number in any correspondence regarding the instrument.

REPLACEMENT PARTS

Standard Components

Birtcher will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts, they are probably obtainable locally faster than can be shipped from Birtcher. Be sure to consult the parts list to see what tolerances are required.

Birtcher Manufactured Parts

Birtcher manufactures almost all of the mechanical parts and some of the electrical components used in this instrument. If you order a mechanical part, be sure to describe the part completely to prevent any unnecessary delay in filling your order. When you have any questions about mechanical parts or electrical components, contact our nearest field sales representative, or write to the service department at the factory in Monterey Park, California.

Replacement of Switches

Since the rotary switches used in the 10CD Module are special, individual switch wafers are generally not replaced. The switches given in the parts list are for un-wired switches. If desired, switches may be ordered wired.

SECTION 4

MAINTENANCE

CALIBRATION

The 10CD Module is a stable instrument and does not require frequent calibration; however, calibration checks should be performed on a regular basis as part of a preventive maintenance program.

PRELIMINARY:

The following equipment is required for complete calibration of the 10CD Module:

1. Microammeter standard to read 100 microamperes, $\pm$ 0.5% or better accuracy; Simpson Model 1703 multi-range standard or equivalent.

2. Multi-range voltmeter standard to read 10 to 1000 volts, $\pm$ 0.5% or better; Simpson Model 1700 or equivalent.

3. Birtcher Type 20012 module extender cable (not necessary, but helpful).

   Connect the 10CD Module with the module extender cable; if not available, remove the Model 70 cover and install the module in normal position. Remove any function plug-in from the 10CD. Mechanically zero the basic unit meters.

VOLTMETER CALIBRATION:

1. Connect the voltmeter standard as shown in figure 4-1 (A) and set the front panel controls in the following positions:

UPPER ADJUST	FULL COUNTERCLOCKWISE
LOWER ADJUST	FULL CLOCKWISE
VOLTAGE RANGE	10 VOLTS
TEST MODE SELECTOR	LEAKAGE

2. Turn on the Model 70 and allow 5 minute warm-up.

3. Set the VOLTAGE ZERO thumbwheel for zero indication on the UPPER METER.

4. Depress the TEST SWITCH and rotate the UPPER ADJUST control clockwise until exactly 10.0 volts is indicated on the standard voltmeter.

CALIBRATION (cont'd)

5. The UPPER METER should agree with the standard voltmeter within ± 2%.

6. Repeat steps 4 and 5 at voltage ranges of 30, 100, 300, and 1000 volts.

CURRENT METER CALIBRATION:

1. Set the front panel controls in the following positions:

UPPER ADJUST	FULL COUNTERCLOCKWISE
LOWER ADJUST	FULL CLOCKWISE
VOLTAGE RANGE	10 VOLTS
CURRENT RANGE	100 MICROAMP
TEST MODE SELECTOR	BREAKDOWN

2. Turn on the Model 70 and allow 5 minute warm-up.

3. Set the VOLTAGE ZERO thumbwheel for zero indication on the UPPER METER.

4. Set R256 CURRENT ZERO ADJUST for zero indication on the lower meter. R256 is located on 10CD chassis.

5. Connect the microammeter standard as shown in figure 4-1 (B).

6. Depress the TEST switch and rotate the UPPER ADJUST control clockwise until exactly 100 microamps is indicated on the microammeter standard.

7. Adjust CURRENT CALIBRATE POTENTIOMETER, R261, for exactly full-scale. R261 is located on the 10CD chassis.

8. Other current ranges may not be calibrated using a current meter. If a full calibration of all current ranges is necessary, the following table may be used by placing an external resistance in place of the the current meter.

   For maximum accuracy, 1/2% resistors should be used and the accuracy of the voltmeter should be considered.

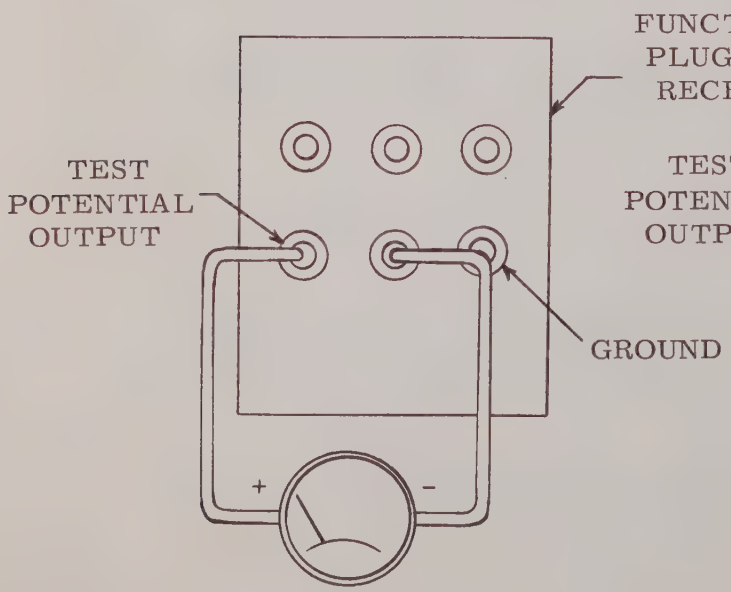
   Use LEAKAGE mode for the following tests.

CALIBRATION (cont'd)

Current Range	External Resistance	Set Voltage	Lower Meter Reading Limits
10 Ma	1K	10V F.S.	9.8 to 10.2 Ma
3 Ma	10K	30V F.S.	2.94 to 3.06 Ma
1 Ma	10K	10V F.S.	.98 to 1.02 Ma
300 ua	100K	30V F.S.	294 to 306 ua
100 ua	100K	10V F.S.	98 to 102 ua
30 ua	1Meg	30V F.S.	29.4 to 30.6 ua
10 ua	1Meg	10V F.S.	9.8 to 10.2 ua
3 ua	10Meg	30V F.S.	2.94 to 3.06 ua
1 ua	10Meg	10V F.S.	.98 to 1.2 ua
300 Na	100Meg	30V F.S.	294 to 306 Na
100 Na	100Meg	10V F.S.	98 to 102 Na
30 Na	1000Meg	30V F.S.	29.4 to 30.6 Na
10 Na	1000Meg	10V F.S.	9.8 to 10.2 Na
3 Na	10000Meg	30V F.S.	2.94 to 3.06 Na
1 Na	10000Meg	10V F.S.	.98 to 1.02 Na
300 Pa	100000Meg	30V F.S.	290 to 310 Pa
100 Pa	100000Meg	10V F.S.	90 to 110 Pa

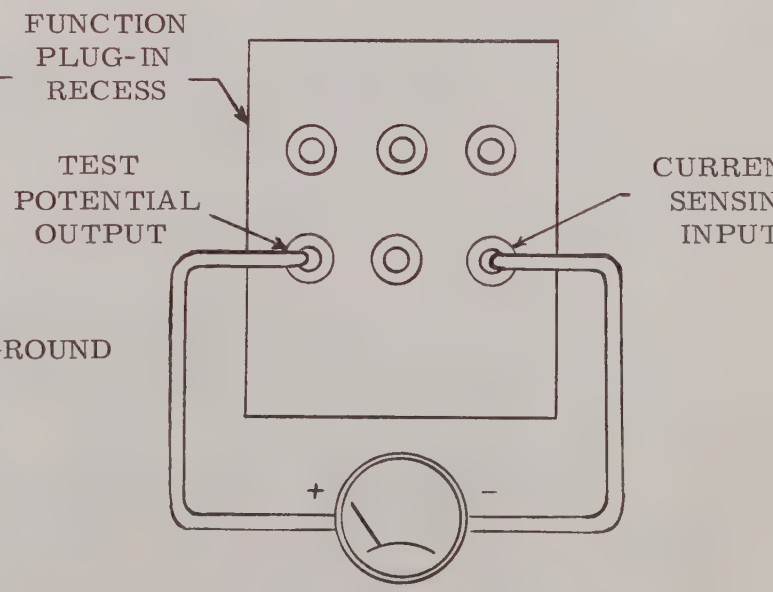
FIGURE 4-1 CALIBRATION CONNECTIONS

(A) VOLTMETER CHECK



VOLTMETER STANDARD

(B) CURRENT CALIBRATION



MICROAMMETER STANDARD

SECTION 5

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
CAPACITORS		
C 201	20 MFD @ 600V, Electrolytic	40078
C 202	20 MFD @ 600V, Electrolytic	40078
C 203	.1 MFD @ 500V, Disc	40386
C 204	.1 MFD @ 500V, Disc	40386
C 205	40-40 MFD @ 300V, Dual Section Electrolytic	40082
C 206	40 MFD @ 350V, Electrolytic	40066
C 207	.1 MFD @ 500V, Disc	40386
C 208	.1 MFD @ 500V, Disc	40386
C 209	.01 MFD @ 1000V, Disc	40026
C 210	.1 MFD @ 100V, 5% Polystyrene	40398
C 211	.1 MFD @.100V, 5% Polystyrene	40398
C 212	.01 MFD @ 200V, Mylar	40046
C 213	.01 MFD @ 1000V, Disc	40026
C 214	40 MFD @ 6V	40058
C 215	.01 MFD @ 1000V, Disc	40026
C 216	40 MFD @ 6V	40058
C 217	8 MFD @ 150V, Electrolytic	40059
C 218	.01 MFD @ 1000V, Disc	40026
C 219	.1 MFD @ 500V, Disc	40386
C 220	1 MFD @ 200V	40389
C 221	820 PFD @ 500V	40044
DIODES		
D 201	R.C.A. 1N3256	40634
D 202	R.C.A. 1N3256	40634
D 203	R.C.A. 1N3256	40634
D 204	Bridge Rectifier, Semtech SCBR6	40623
D 205	Semtech, SC-1	40553
D 206	Motorola, 1N3021B	40637
D 207	International Rectifier, 1N745	40638
D 208	Semtech, SC-1	40553
D 209	Semtech, SC-1	40553
RELAY		
K 201	DPDT, 6V Coil	40160

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
RESISTORS	(1/2W, ± 10% Carbon, Unless Otherwise Specified)	
R 201	1 Meg	40442
R 202	1 Meg	40442
R 203	1.5K, 2W	40184
R 204	1.5K, 2W	40184
R 205	1 Meg, 2W	40256
R 206	10K	40186
R 207	10K	40186
R 208	1Meg, 2W	40256
R 209	68 Ohm, 1W	40191
R 210	330K	40229
R 211	100K	40438
R 212	270K	40235
R 213	270K	40235
R 214	100 Ohm, 1W	40190
R 215	50K, Variable	40676
R 216	27K	40215
R 217	197.5K, ± 1/2%, Film, Mtl	40313
R 218	400K, ± 1/2%, Film, Mtl	41047
R 219	1.4 Meg, 1/2W, 1% Dep. Carbon	40335
R 220	4 Meg, 1W, 1% Dep. Carbon	40340
R 221	14 Meg, 2W, 1% Dep. Carbon	40346
R 222	10 Meg, ± 1%, 2W, Dep. Carbon	40345
R 223	3.33 Meg, ± 1%, 1W, Dep. Carbon	41098
R 224	1 Meg, ± 1/2%, 1/2W, Dep. Carbon	40326
R 225	333K ± 1/2%, 1/2W, Film, Mtl	41089
R 226	100K ± 1/2%, 1/2W, Film, Mtl	40309
R 227	33.3K ± 1/2%, 1/2W, Film, Mtl	41115
R 228	10K ± 1/2%, 1/2W, Film, Mtl	40288
R 229	3.33K ± 1/2%, 1/2W, Film, Mtl	40281
R 230	1.0K ± 1/2%, 1/2W, Film, Mtl	40275
R 231	333 Ohm ± 1/2%, 1/2W, Film, Mtl	40270
R 232	100 Ohm ± 1/2%, 1/2W, Film, Mtl	40265
R 233	33.3 Ohm ± 1/2%, 1/2W, Film, Mtl	40261
R 234	10 Ohm ± 1/2%, 1/2W, Film, Mtl	40258
R 235	3.33 Ohm ± 1/2%, 1/2W, WW	40357
R 236	1.0 Ohm ± 1/2%, 1/2W, WW	40356
R 237	0.333 Ohm ± 1/2%, 1/2W, WW	40355
R 238	0.100 Ohm ± 1/2%, 1/2W, WW	40358
R 239	3.5K, 5W, WW	40694
R 240	3.5K, 5W, WW	40694
R 241	100K	40438
R 242	100K	40438

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
RESISTORS (Continued)		
R 243	33 Ohm, 2W	40164
R 244	470K	40230
R 245	47K	40214
R 246	10 Ohm, .5%, 1/2W, Mtl Film	40258
R 247	10K	40186
R 248	47K	40214
R 249	4.7 Meg	40444
R 250	1 Meg	40442
R 251	10K	40186
R 252	22 Meg	40257
R 253	4.7 Meg	40444
R 254	2.7K	40180
R 255	100K	40438
R 256	10K, Variable	40667
R 257	330K	40229
R 258	1 Meg	40442
R 259	100K	40438
R 260	47K, 1W	40223
R 261	10K, Variable	40667
R 262	12K	40212
R 263	100K	40438
R 264	10K	40186
R 265	4.7K	40429
R 266	10 Meg	40443
R 267	3.3 Meg	40253
R 268	1 Meg	40442
R 269	330K	40229
R 270	100K	40438
R 271	33K	40213
R 272	10K	40186
R 273	3.3K	40181
R 274	1K	40426
R 275	470K	40230
SWITCHES (Unwired)		
S 201	Rotary, 2 Pole, 5 Position	40869
S 202	Rotary, 5 Pole, 17 Position	40870
S 203	Lever, 12 Pole, 2 Position	40798

SECTION 5 PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
TRANSFORMER		
T 201	Filament, 12.6 Volt CT @ .6 Amp	40873
TUBES		
V 201	6AU6	40522
V 202	12AT7	40532
V 203	6S4A	40525
V 204	6S4A	40525
V 205	OA2	41036
V 206	OA2	41036
V 207	12AX7A	40527
V 208	6U8A	40523
CHOPPER		
X 201	DPDT, Low Noise	40095
MODULE CONNECTOR		
P 101	50 Pin Amphenol	40102
PILOT		
DS 201	6.3 Volt Cartridge	40132

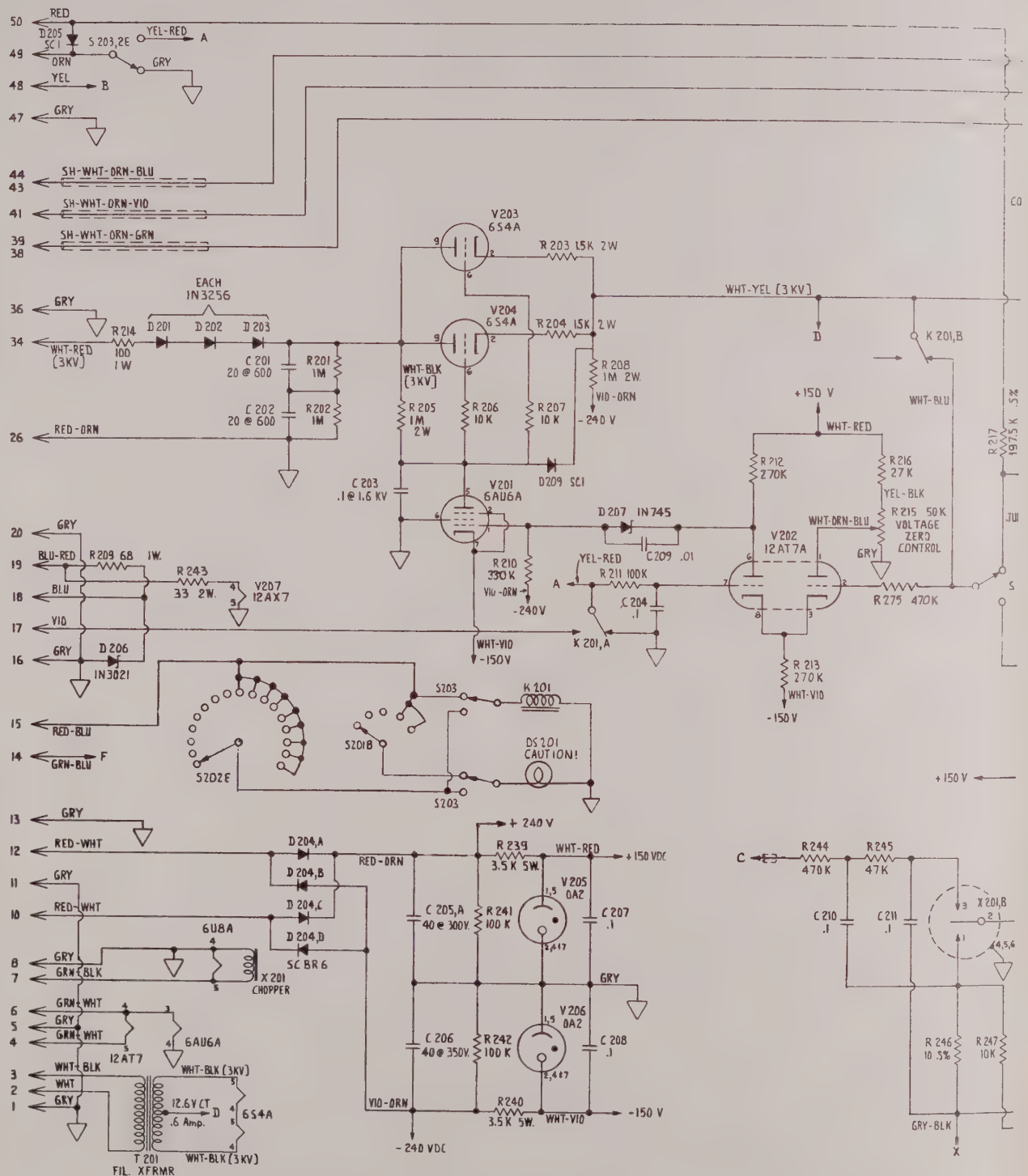
SECTION 5 PARTS LIST

FIELD REPLACEMENT SPARE PARTS LIST

QUANTITY RECOMMENDED	DESCRIPTION	BIRTCHER PART NUMBER
1	Vacuum Tube 6AU6	40522
1	Vacuum Tube 12AT7	40532
2	Vacuum Tube 6S4A	40525
2	Vacuum Tube 0A2	41036
1	Vacuum Tube 12AX7A	40527
1	Vacuum Tube 6U8A	40523
1	Chopper DPDT, Low Noise	40095
1	Pilot Lamp, 6.3V Cartridge	40132

ISOLATED SERVICE SPARE PARTS LIST
(In addition to parts listed above)

QUANTITY RECOMMENDED	DESCRIPTION	BIRTCHER PART NUMBER
1	Relay, DPDT 6V coil	40160
1	Transformer, Filiment, 12.6V CT @ .6Amp	40873
1	Connector, 50 Pin Amphenol	40102
1	Switch, Voltage Range (wired)	30022
1	Switch, Current Range (wired)	30023
1	Switch, Mode (unwired)	40798
3	Diode, RCA 1N3256	40634
1	Diode, Bridge Rectifier, Sem Tech SCBR6	40623
3	Diode, Sem Tech SC 1	40553
1	Diode, Motorola 1N3021B	40637
1	Diode, International Rectifier 1N745	40638

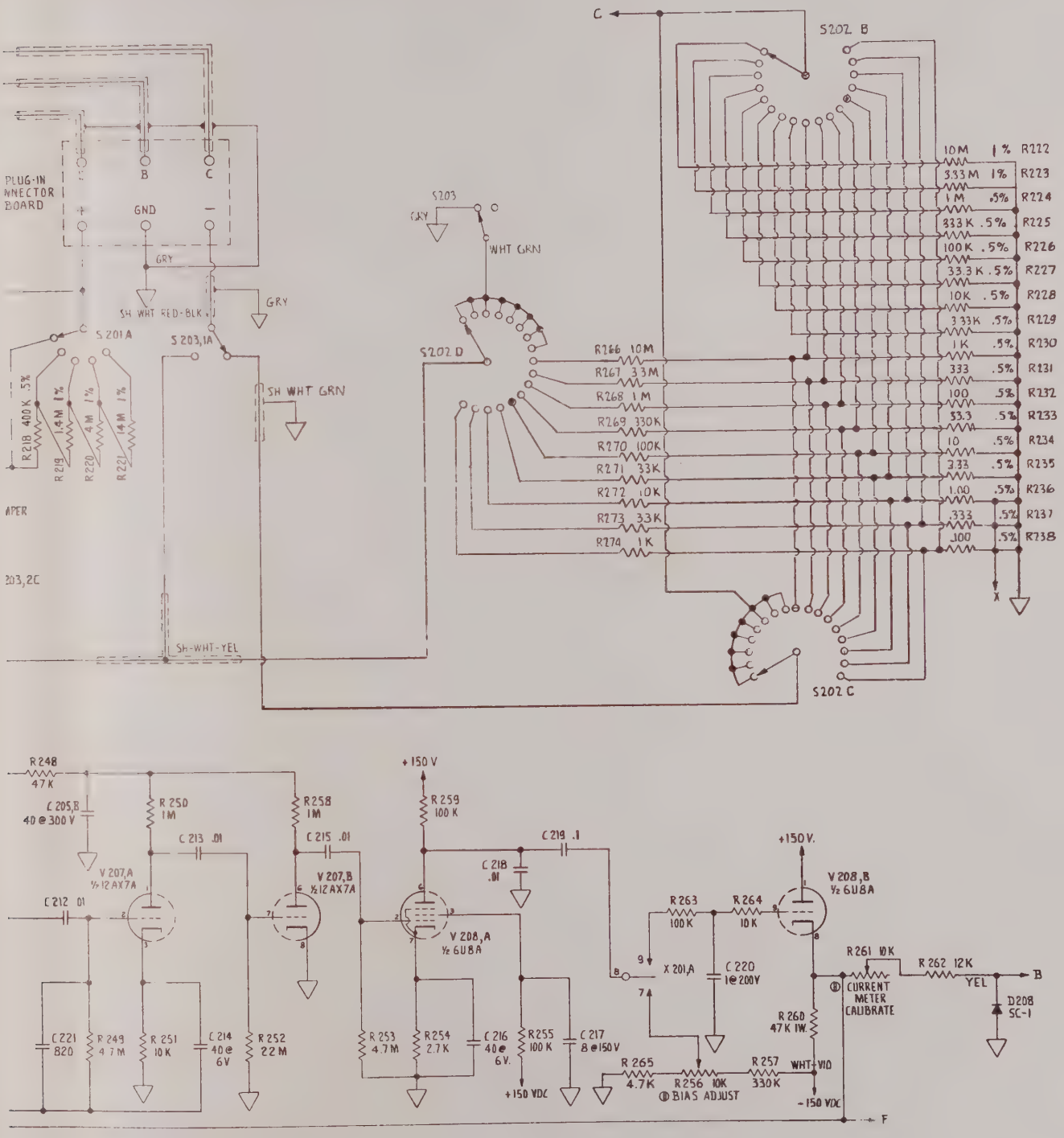


4. S203 SHOWN IN LEAKAGE POSITION.
3. ROTARY SWITCHES SHOWN IN MOST CCW POSITION.
2. CAPACITANCES IN μfd. @ 500 V.
1. RESISTORS, ½W, ±10%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED

FRONT PANEL CONTROLS.

S 201	VOLTAGE RANGE.
S 202	CURRENT RANGE.
S 203	TEST SUPPLY MODE
R 215	VOLTAGE ZERO CONTROL
DS 204	WARNING LAMP (HIGH VOLTAGE)



REV.	DESCRIPTION	DATE	DRAWN	APP'D
B	REVISED S202 - ADDED C209 - R275 R203 & R274 WERE 1K R210 WAS 1.5M	4-1-68		RM
A	REVISED S 201 ; S 202 AND R 253 WAS 2.7M	11-30-66	E.B.	RGJ

THE BIRTCHER CORP. —— INDUSTRIAL DIVISION.

SCHEMATIC

LEAKAGE & BREAKDOWN TEST MODULE.

TYPE 10CD SERIAL NO. 2238 & UP

DRAWN : E. Bodeman	APP'D : R [illegible]	REV.
DATE : 5-28-65	DATE : 8-15-65	B

DWG. NO. D 1452

WARRANTY

All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing parts which prove to be defective during the warranty period. We are not liable for consequential damage.

For assistance of any kind, including help with instruments under warranty, contact your authorized Birtcher sales representative for instructions. Give full details of the difficulty and include the instrument model and serial number. Service data or shipping instructions will be promptly sent to you. There will be no charge for repair of instruments under warranty, except transportation charges. Estimates of charges for non-warranty or other service work will always be supplied if requested before work begins.

Serial Number_____